

Virtual Telescope Alignment System

Completed Technology Project (2014 - 2015)



Project Introduction

Next-generation space telescopes require two spacecraft to fly in a coordinated fashion in space forming a virtual telescope. Achieving and maintaining this precise formation alignment is achieved with guidance, navigation, and control (GN&C). The Virtual Telescope Alignment System (VTAS) is a prototype GN&C system to sense and maintain on-target formation alignment. This project is a multi-year effort focused on the development, integration, and testing of the VTAS using commercial CubeSat-class hardware and in-house developed software.

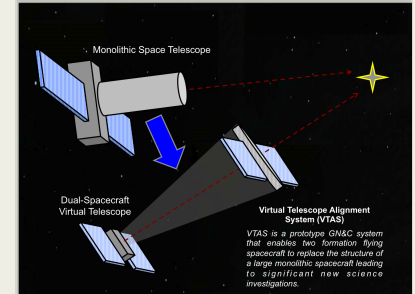
This multi-year effort is to develop a prototype GN&C system (sensors, actuators, and algorithms), VTAS, and test it on the ground as a means for maturing the TRL of this systems-level technology. Raising the maturity of a prototype system reduces the risk for missions requiring dual spacecraft precise inertial alignment. Heliophysics and Astrophysics missions such as a solar coronagraph, exo-planet finder, black hole x-ray and gamma-ray imager, solar flare x-ray and extreme ultraviolet imager, etc benefit from this advancement.

Next-generation space telescopes require large separation distances between two elements of a science payload such as an occulting disk and a camera, or a lens and detector, making them too large to launch into space. A solution to this problem is to replace the structure of a traditional large monolithic space telescope with the science payload and GN&C distributed amongst the two spacecraft. For example, a solar coronagraph requires an occulting disk on one spacecraft and a camera on the other spacecraft with the two spacecraft separated by a large distance (hundreds of meters) with precise inertial alignment on the order of sub-arc-seconds. The two spacecraft use GN&C to fly in coordination and align themselves to an inertial target of interest. Formation flying offers the ability to increase the separation distance, which leads to decreased errors from vignetting and diffracted light.

Anticipated Benefits

Numerous Heliophysics and Astrophysics applications will benefit from this risk-reduction development effort including but not limited to: solar coronagraph, extreme ultraviolet imaging of the sun, x-ray imaging of the sun, x-ray imaging of stellar binaries, x-ray imaging of the event horizon of a black hole, and planet finder missions.

This development will increase the capability for automated rendezvous and docking of vehicles as well as formation flight with asteroids.



VTAS enables distributed space telescopes

Table of Contents

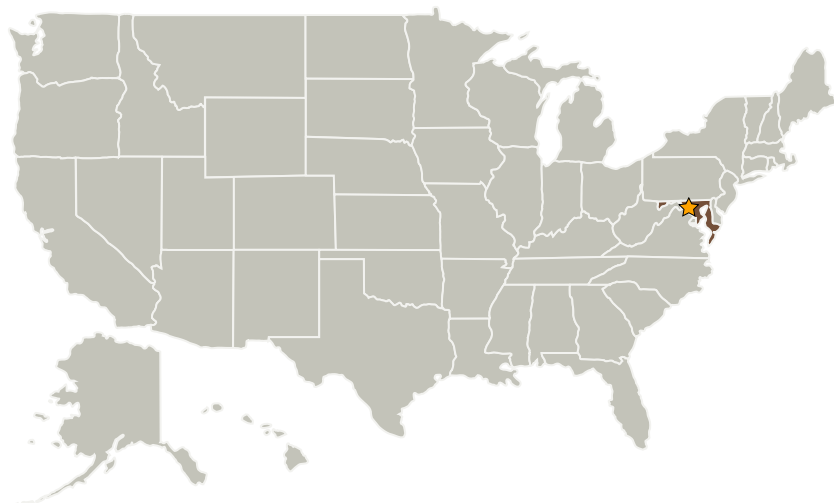
Project Introduction	1
Anticipated Benefits	1
Primary U.S. Work Locations and Key Partners	2
Organizational Responsibility	2
Project Management	2
Images	3
Stories	3
Links	3
Project Website:	3
Technology Maturity (TRL)	3
Technology Areas	3

Virtual Telescope Alignment System

Completed Technology Project (2014 - 2015)



Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations

Maryland

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Center Independent Research & Development: GSFC IRAD

Project Management

Program Manager:

Peter M Hughes

Project Manager:

Dennis W Woodfork

Principal Investigator:

Neerav Shah

Co-Investigators:

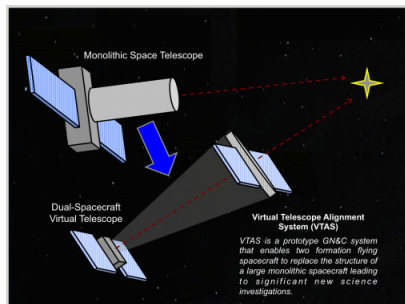
Philip C Calhoun
Sean R Semper

Virtual Telescope Alignment System

Completed Technology Project (2014 - 2015)



Images



VTAS Concept Image

VTAS enables distributed space telescopes

(<https://techport.nasa.gov/image/4170>)

Stories

Making Cubesats do Astronomy

(<https://techport.nasa.gov/file/3441>)

NASA Creating a Virtual Telescope with Two Small Spacecraft

(<https://techport.nasa.gov/file/3436>)

NASA wants to drift two satellites for awesome space pics

(<https://techport.nasa.gov/file/3442>)

Links

GSC-16745-1

(no url provided)

GSC-17002-1

(no url provided)

GSC-17298-1

(no url provided)

GSC-17338-1

(no url provided)

GSC-17372-1

(no url provided)

Project Website:

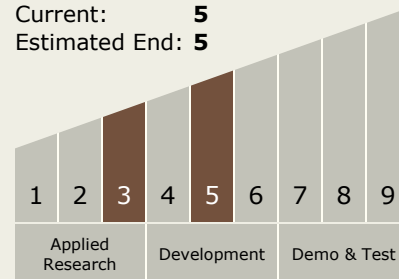
<http://aetd.gsfc.nasa.gov>

TechPort

Printed on 12/07/2022
07:34 PM UTC

Technology Maturity (TRL)

Start: 3
Current: 5
Estimated End: 5



Technology Areas

Primary:

- TX08 Sensors and Instruments
 - TX08.2 Observatories